Economic Measures of R&D

Latest Developments in U.S. National R&D

The United States is spending more money on R&D than ever before, even when the amounts are adjusted for inflation. In 1998 (the most recent year for which R&D expenditure data are available at this writing), total R&D expenditures in the United States reached $227.2 billion.[1] Moreover, the rate at which R&D has been increasing in recent years has been impressive. The $227.2 billion total for 1998 reflects a nominal growth rate (without accounting for inflation) of 7.5 percent over the 1997 level of $211.3 billion, or a real growth rate (after adjusting for inflation) of 6.5 percent.[2] Similar growth occurred in 1997: The 1997 level of R&D reflects a 7.5 percent nominal growth over the $196.5 billion spent in 1996, or 5.5 percent real growth.

By comparison, the U.S. GDP,[3] the main measure of the nation's total economic activity, grew in real terms by 3.9 percent per year in 1997 and 1998. Such growth in the GDP is exceptionally high, yet it is slower than the growth of R&D. R&D has generally been outpacing the overall growth of the economy since 1994. As a result, R&D as a proportion of GDP has been on the rise as well—from 2.43 percent in 1994 to 2.67 percent in 1998.

Organizations that conduct R&D often receive outside funding; likewise, organizations that fund R&D often do not perform as much R&D as the amount of money they devote to it. Therefore, any discussion of the nation's R&D must always be careful to distinguish between where the money comes from originally and where the R&D is actually performed. That is, R&D expenditures can be categorized, respectively, by source of funds or by performer.

By source of funds, most of the nation's R&D is paid for by private industry, which provided 65.9 percent ($149.7 billion) of total R&D funding in 1998. Nearly all of these funds (98 percent) were used by private industry itself in the performance of its own R&D, and most of these funds (70 percent) were for the development of products and services rather than for research. In 1998, the Federal Government provided the next largest share of R&D funding—29.5 percent ($66.9 billion dollars)—and the other sectors of the economy (state governments, universities and colleges, and nonprofit institutions) contributed the remaining 4.7 percent ($10.6 billion). (See figures 2-1, 2-2, and 2-3 and text table 2-1.)

By performer, industry in 1998 accounted for an even larger share of the total—74.4 percent; universities and colleges accounted for 11.6 percent, and the Federal Government accounted for 7.6 percent. Federally Funded Research and Development Centers (FFRDCs)—which are administered by various industrial, academic, and nonprofit institutions—accounted for an additional 3.8 percent, and other nonprofit organizations accounted for 2.6 percent. (See figures 2-2 and 2-3.)[4]

R&D Growth Trends

Between 1953 and 1969 R&D expenditures grew at a real annual rate of 8.2 percent.[5] Starting in 1969, however, and for nearly a decade thereafter, R&D growth failed to keep up with either inflation or general increases in economic output. In fact, between 1969 and 1975, real R&D expenditures declined by 1 percent per year as business and government tended to deemphasize research programs. (See figure 2-1.)

[1] Projections for 1998 and preliminary tabulations for 1997 were based in part on time-series modeling techniques. Except for discussions of the Federal budget authority, which refer to fiscal years, other references to years in this chapter refer to calendar years, not fiscal years (even in discussions of academic and Federal intramural performance). Other chapters in this report and other NSF reports on academic or Federal expenditures alone, however, often refer to fiscal years because those institutions operate on a fiscal year basis. Calendar years are used in this chapter and in the NSF reports *National Patterns of R&D Resources* and *Research and Development in Industry*, however, for consistency with industry data, which represent three-fourths of U.S. R&D expenditure, and for consistency with the vast majority of all other national economic statistics provided by Federal statistical agencies.

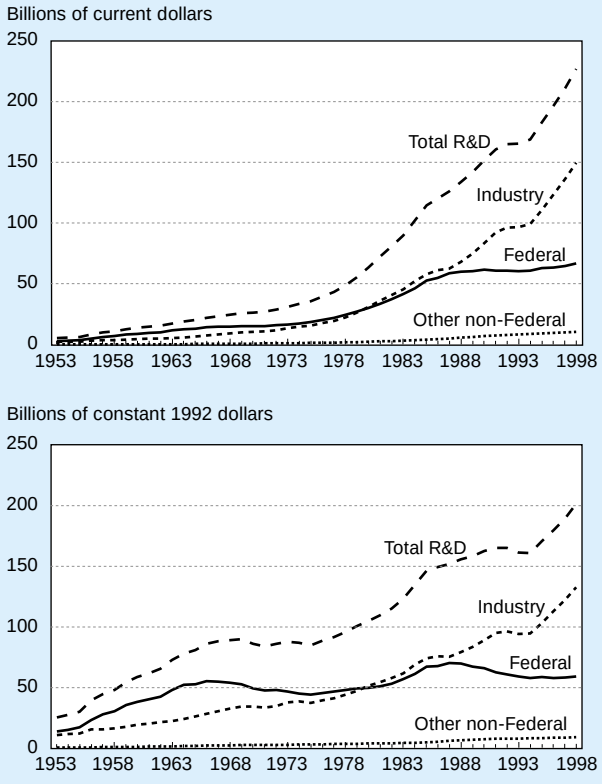
[2] For a discussion of how dollar amounts are adjusted for inflation, see "Appendix A: Controlling for Inflation and Foreign Currency," in NSF (1999c).

[3] For historical data on the GDP, see appendix table 2-1.

[4] In some of the statistics provided below, FFRDCs are included as part of the sector that administers them. In particular, statistics on the industrial sector often include industry-administered FFRDCs as part of that sector because some of these statistics from the NSF Industry R&D Survey cannot be separated with regard to the FFRDC component. Whenever a sector is mentioned in this chapter, the wording used will specify whether FFRDCs are included.

[5] For additional background on U.S. R&D in the 1950s, see chapter 1.

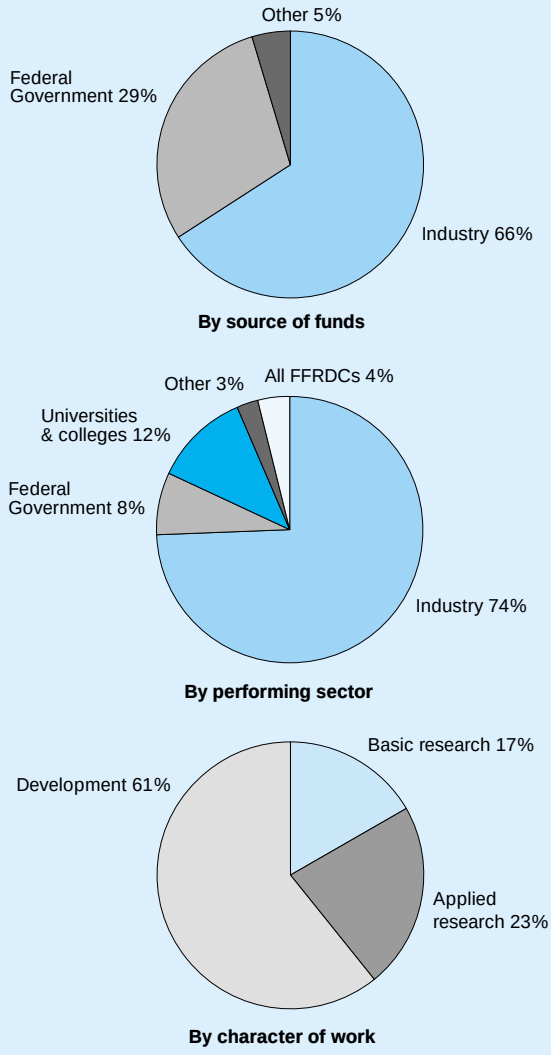
Figure 2-1.
National R&D funding, by source: 1953–1998



See appendix tables 2-5 and 2-6.

Science & Engineering Indicators – 2000

Figure 2-2.
National R&D expenditures: 1998



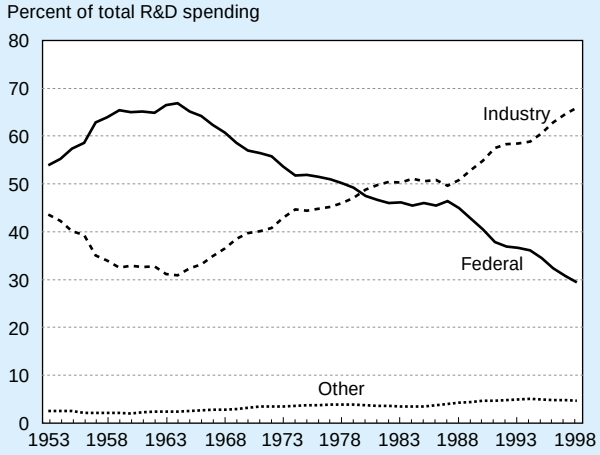
FFRDCs = Federally Funded Research and Development Centers

NOTE: Data labels rounded to nearest whole number.

See appendix tables 2-3, 2-5, 2-7, 2-11, and 2-15.

Science & Engineering Indicators – 2000

Figure 2-3.
National R&D expenditures, by source of funds



See appendix table 2-5. *Science & Engineering Indicators – 2000*

Federal funding in particular fell 19 percent in real terms during this period; this decrease was felt in defense- and nondefense-related programs (as discussed in greater detail below).

The situation turned around in the mid-1970s. Following an economic recovery from the 1974 oil embargo and the 1975 recession, R&D expenditures increased in real terms by approximately 72 percent from 1975 to 1985 (5.6 percent per year), compared with a 37 percent rise in real GDP over the same period. During the first half of this period (1975–80), there was considerable growth in Federal R&D funding for nondefense activities. Although defense-related R&D expenditures rose as well, much of the Federal R&D gain was attributable to energy-related R&D (particularly nuclear energy development) and to greater support for health-related R&D. Non-Federal R&D increases were concentrated in industry and resulted largely from greater emphasis on energy conservation and improved use of fossil fuels. Consequently, energy concerns fostered increases in R&D funding by Federal and non-Federal sources. In particular, support for energy R&D rose more than 150 percent in real terms between 1974 and 1979 and accounted for approximately one-half of the national increase in real R&D spending.

Overall, the 1975–80 R&D recovery witnessed an average growth rate of 4.4 percent per year. That annual rate remained between 4 and 5 percent through 1982, though the early 1980s saw a heavy shift toward defense-related activities. As a result of these increases in defense R&D, growth in real R&D expenditures accelerated to an average annual rate of 8.2 percent over 1982–85. Such rapid growth had not been seen since the post-Sputnik era of the early 1960s.

On average, R&D spending increased 6.8 percent per year in real terms in the first half of the 1980s. The situation then changed abruptly again. From 1985 to 1994, average annual R&D growth after inflation slowed to 1.1 percent, compared with a 2.4 percent annual real growth in GDP. Reductions in Federal and non-Federal funding of R&D as a proportion of GDP had contributed to this slowing. However, the decline in real Federal R&D funding was the primary factor in the slow growth of R&D in the early 1990s.[6]

This downward trend reversed again in 1994, as a result of substantial increases in industrial R&D.[7] R&D in the United

[6] These findings are based on performer-reported R&D levels. In recent years, increasing differences have been detected in data on Federally financed R&D as reported by Federal funding agencies, on the one hand, and by performers of the work (Federal labs, industry, universities, and other nonprofit organizations), on the other hand. For a discussion of this divergence in R&D totals, see sidebar, "Accounting for Defense R&D: Gap Between Performer- and Source-Reported Expenditures."

[7] For a detailed discussion of this upturn, see Jankowski (1999).

Text table 2-1.
U.S. R&D expenditures, by performing sector, source of funds, and character of work: 1998
(Millions of U.S. dollars)

Character of work/ sources of funds	Performer: Federal Government	Industry[a]	Universities and colleges	U&C associated FFRDCs[b]	Other nonprofit institutions[a]	Total	Percent distribution by sources
TOTAL R&D							
Federal Government	17,189	24,589	15,558	5,517	4,077	66,930	29.5%
Industry	..	146,706	1,896	..	1,051	149,653	65.9%
Universities and colleges	..	..	7,049	..	..	7,049	3.1%
Other nonprofit institutions	..	..	1,840	..	1,702	3,541	1.6%
Total.	17,189	171,295	26,343	5,517	6,830	227,173	100.0%
Percent distribution, performers	7.6%	75.4%	11.6%	2.4%	3.0%	100.0%	
BASIC RESEARCH							
Federal Government	2,920	1,816	11,248	2,721	1,531	20,235	53.4%
Industry	..	9,625	1,205	..	483	11,313	29.9%
Universities and colleges	..	..	4,479	..	..	4,479	11.8%
Other nonprofit institutions	..	..	1,169	..	681	1,850	4.9%
Total.	2,920	11,441	18,100	2,721	2,695	37,877	100.0%
Percent distribution, performers	7.7%	30.2%	47.8%	7.2%	7.1%	100.0%	
APPLIED RESEARCH							
Federal Government	5,421	3,087	3,130	1,545	1,144	14,326	28.0%
Industry	..	32,701	567	..	357	33,625	65.6%
Universities and colleges	..	..	2,107	..	..	2,107	4.1%
Other nonprofit institutions	..	..	550	..	613	1,163	2.3%
Total.	5,421	35,788	6,354	1,545	2,114	51,221	100.0%
Percent distribution, performers	10.6%	69.9%	12.4%	3.0%	4.1%	100.0%	
DEVELOPMENT							
Federal Government	8,848	19,686	1,181	1,251	1,403	32,369	23.4%
Industry	..	104,380	124	..	210	104,715	75.8%
Universities and colleges	..	..	463	..	..	463	0.3%
Other nonprofit institutions	..	..	121	..	408	529	0.4%
Total.	8,848	124,066	1,888	1,251	2,021	138,075	100.0%
Percent distribution, performers	6.4%	89.9%	1.4%	0.9%	1.5%	100.0%	

FFRDC = Federally Funded Research and Development Center

NOTE: State and local government funds are included in industry funds reported to industry performers, and in university and college funds reported to university and college performers. Details may not add to totals because of rounding.

[a]Expenditures for FFRDCs administered by both industry and nonprofit institutions are included in the totals of their respective sectors. They are estimated to account for less than 2 percent and 12 percent, respectively, of the industry and nonprofit institutions performance totals. FFRDCs are organizations exclusively or substantially financed by the Federal Government to meet a particular requirement or to provide major facilities for research and training purposes.

[b]FFRDCs administered by individual universities and colleges and by university consortia.

See appendix tables 2-3 , 2-7, 2-11, and 2-15.

Science & Engineering Indicators – 2000

States grew in real terms by 5.8 percent per year between 1994 and 1998, in spite of virtually no real growth (0.6 percent per year) in Federal R&D support. Over the same period, industrial support for R&D grew at a real annual rate of 8.9 percent. Much of this increase might be explained by the favorable economic conditions that generally existed during the period.

Trends in Financial Support for R&D

Federal Support by National Objective

Federal Funding Trends

In recent years the Federal Government has contributed smaller shares of the Nation's R&D funding. The Federal Government once was the main provider of the Nation's R&D funds—accounting for 54 percent in 1953 and as much as 67